

FIG. 1.

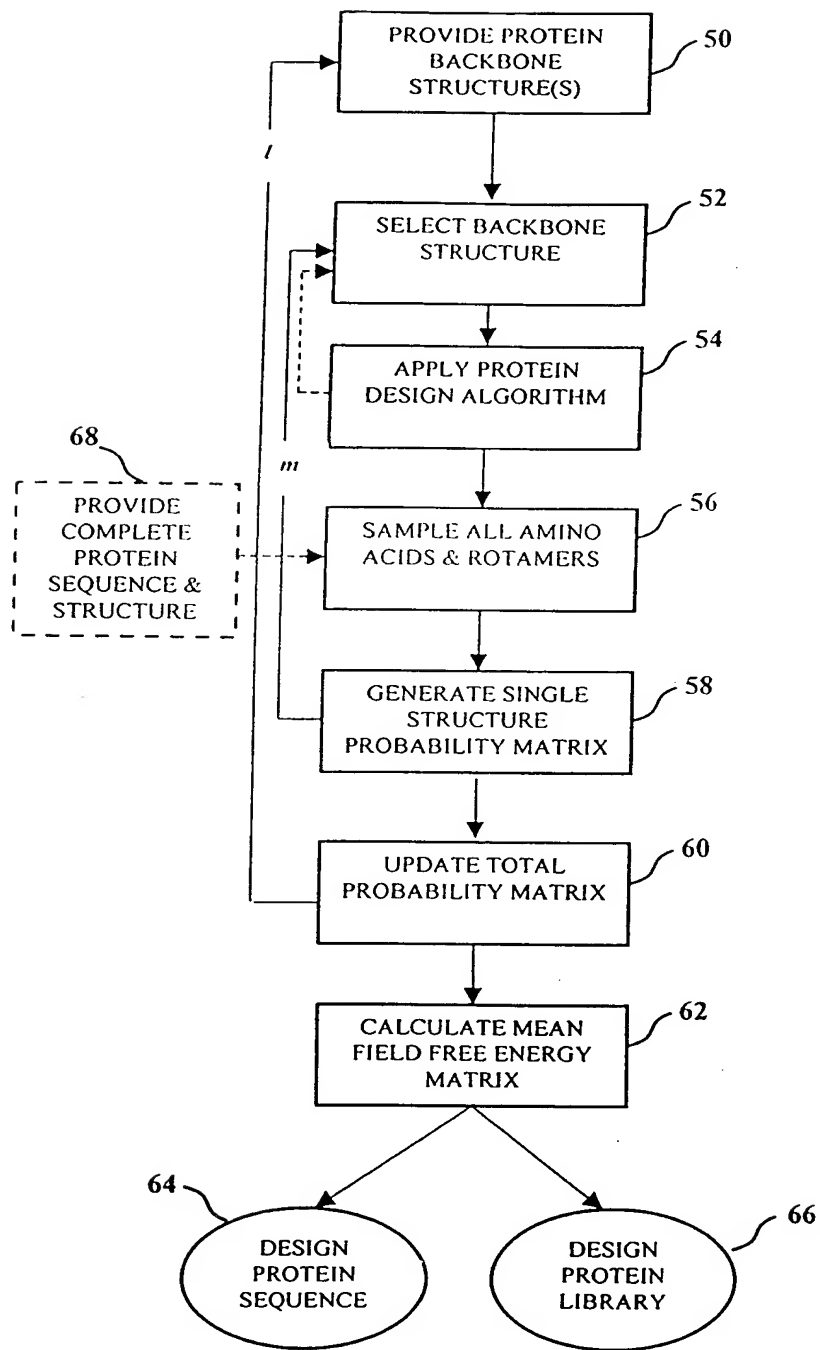


FIG. 2.

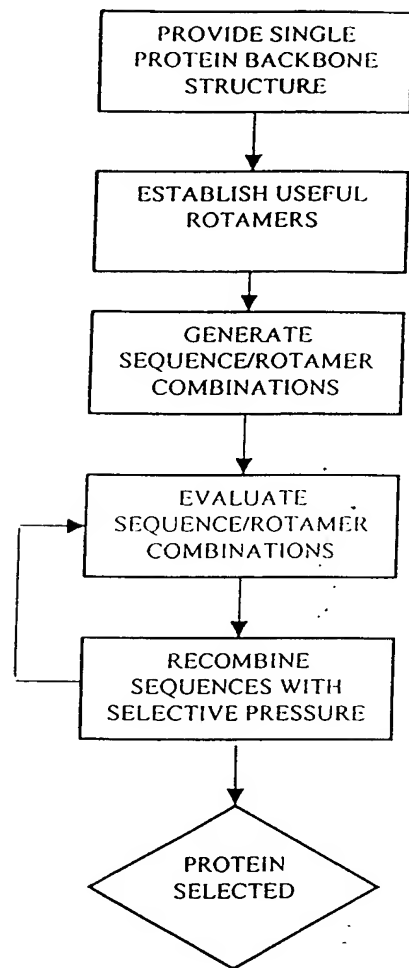


FIG. 3.

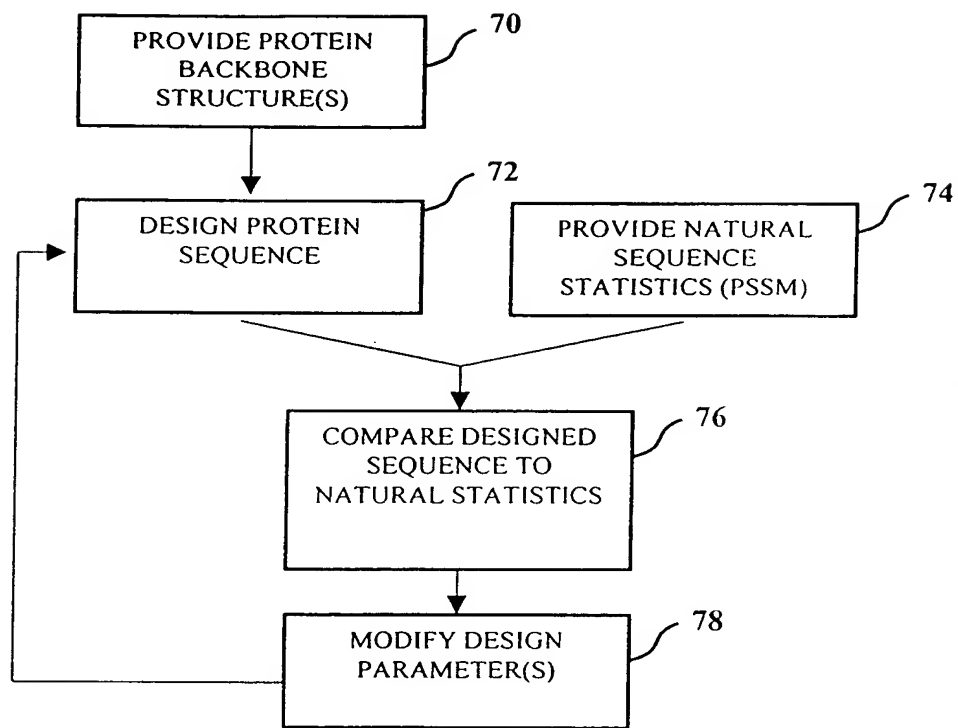


FIG. 4.

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| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
|---|-----|-----|-----|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| A | 1.7 | 10 | 4.9 | 2 | 16 | 17 | 6.5 | 4.9 | 4.8 | 4.2 | 3.8 | 0.5 | 1.9 | 4.7 | 1.7 | 3.5 | 4.6 | 18 | 8.7 | 10 | 7.7 | 3.6 | 3.5 | 4.8 | 3.9 | 4.1 | 3.8 | 9.1 | 2.1 | 3.9 | 6 | 10 | 5.3 | 4.7 |
| C | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| D | 0.7 | 17 | 7.1 | 4 | 20 | 50 | 5.8 | 3.7 | 3.5 | 9.2 | 8.2 | 2.4 | 3.5 | 0.3 | 0.4 | 4.7 | 5.4 | 20 | 20 | 19 | 6.2 | 5.8 | 2.4 | 5.4 | 0.7 | 2.9 | 7.5 | 4.6 | 1.2 | 4.4 | 2.3 | 17 | 7.7 | 0.2 |
| E | 1.5 | 16 | 6.5 | 2.6 | 20 | 20 | 3.7 | 2.3 | 2.3 | 5.1 | 4.7 | 4.2 | 3.2 | 4.2 | 1 | 3.5 | 3.5 | 19 | 18 | 6.8 | 13 | 1.7 | 2 | 5.5 | 3.2 | 2.2 | 3.3 | 8.8 | 2.3 | 3 | 4.4 | 17 | 5.7 | 1.9 |
| F | 50 | 9.5 | 20 | 50 | 20 | 3.8 | 17 | 7.1 | 7.2 | 8 | 4.1 | 50 | 50 | 20 | 50 | 3.9 | 7 | 2 | 2.3 | 3.1 | 20 | 5.8 | 14 | 20 | 50 | 5 | 11 | 17 | 50 | 20 | 9.3 | 16 | 7.9 | 50 |
| G | 3.9 | 4.1 | 7.7 | 4.4 | 0 | 20 | 12 | 8.9 | 13 | 8.9 | 11 | 2.8 | 0.9 | 8.1 | 2.8 | 9.3 | 6.8 | 20 | 18 | 19 | 19 | 8.7 | 8.2 | 11 | 3.1 | 10 | 6.1 | 14 | 1.4 | 6 | 9 | 19 | 10 | 7.4 |
| H | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| I | 50 | 8.6 | 7.8 | 15 | 20 | 11 | 5.4 | 4 | 8.7 | 4.9 | 6.2 | 50 | 50 | 19 | 50 | 4.1 | 5.1 | 16 | 11 | 11 | 17 | 4.9 | 3 | 10 | 50 | 2.3 | 2.1 | 7.3 | 6.6 | 6.7 | 5.8 | 14 | 4.8 | 50 |
| K | 4.8 | 6.7 | 7.1 | 6 | 17 | 18 | 6.2 | 2 | 2.8 | 2 | 0.5 | 7.5 | 6.1 | 9.3 | 4.6 | 4 | 5.5 | 15 | 10 | 7.9 | 5.2 | 0.6 | 3 | 5.9 | 3.5 | 3.1 | 1.3 | 4.7 | 3 | 4.3 | 2.6 | 14 | 5.8 | 6.5 |
| L | 50 | 0.3 | 9.5 | 20 | 19 | 9.2 | 4 | 4.7 | 1.1 | 4.3 | 3.4 | 50 | 50 | 9.6 | 50 | 5.5 | 7.3 | 11 | 5.1 | 7.9 | 8.4 | 3.4 | 5.2 | 7.5 | 50 | 5.4 | 4.3 | 7.8 | 50 | 8.4 | 4.6 | 17 | 5.3 | 50 |
| M | 50 | 3.1 | 11 | 14 | 19 | 11 | 7 | 7.9 | 5.9 | 6.1 | 6.9 | 50 | 50 | 15 | 50 | 6 | 6.8 | 12 | 4.9 | 9.5 | 6.1 | 6.3 | 7.4 | 12 | 50 | 8.5 | 5.5 | 6.6 | 6.7 | 11 | 6.4 | 16 | 7.1 | 50 |
| N | 0.6 | 20 | 5.9 | 4 | 19 | 50 | 6.4 | 2.8 | 3.3 | 7.1 | 5.1 | 3.6 | 3.4 | 1.3 | 0.8 | 3.7 | 4.4 | 20 | 14 | 14 | 1.2 | 2.8 | 3 | 4.8 | 1 | 3.6 | 6.1 | 5.5 | 0.2 | 3.9 | 1.6 | 15 | 4.9 | 1 |
| P | 11 | 20 | 0.4 | 7.1 | 20 | 20 | 2.2 | 20 | 6.7 | 20 | 5.3 | 20 | 20 | 4.9 | 20 | 20 | 20 | 20 | 20 | 18 | 20 | 20 | 9.6 | 18 | 20 | 20 | 5.7 | 17 | 2.5 | 17 | 4.6 | 0.3 | 20 | 8.7 |
| Q | 2.8 | 11 | 6.2 | 4.2 | 19 | 20 | 4.9 | 1.8 | 2 | 3.6 | 2.7 | 5.4 | 4.2 | 4 | 2.4 | 2.2 | 3.5 | 15 | 15 | 5.7 | 5.3 | 1.3 | 2.6 | 5.6 | 4 | 1.8 | 2 | 1.2 | 3.4 | 3.6 | 1.6 | 16 | 6.1 | 3.5 |
| R | 2.6 | 11 | 5.5 | 4.6 | 18 | 20 | 6.3 | 2.5 | 2.4 | 2.7 | 3 | 5.4 | 4.4 | 8.3 | 2.2 | 3.4 | 4.8 | 18 | 17 | 11 | 3.9 | 1.9 | 3.2 | 5.8 | 4.4 | 2.1 | 2 | 6.6 | 3.6 | 2.4 | 1.1 | 16 | 5.7 | 3.6 |
| S | 0.4 | 9.6 | 6.4 | 0.7 | 18 | 20 | 5.3 | 5.2 | 3.4 | 4.5 | 4.1 | 0.8 | 0.3 | 3.6 | 1 | 1.5 | 2.3 | 20 | 13 | 50 | 3.1 | 3.8 | 2.9 | 1 | 3.3 | 3.1 | 4.8 | 6.1 | 2.6 | 1.3 | 2.4 | 12 | 5.3 | 2.1 |
| T | 3.8 | 7.7 | 11 | 4.8 | 20 | 18 | 0.2 | 4.1 | 6.3 | 1.4 | 4.4 | 6.2 | 6.7 | 9.2 | 2.4 | 0.5 | 0.7 | 19 | 9.8 | 50 | 10 | 3.1 | 0.6 | 0.5 | 8.4 | 1.7 | 1.4 | 0.3 | 3.7 | 0.1 | 3 | 10 | 0.1 | 2.6 |
| V | 50 | 9.2 | 10 | 10 | 20 | 11 | 2.6 | 2.2 | 6.4 | 2.6 | 3.6 | 50 | 50 | 17 | 50 | 2 | 1.6 | 17 | 12 | 8.9 | 11 | 2 | 2.6 | 5.7 | 50 | 0.8 | 0.5 | 4.8 | 5.8 | 6.6 | 2.6 | 7.6 | 2.7 | 50 |
| W | 50 | 14 | 20 | 50 | 20 | 0.3 | 20 | 15 | 11 | 12 | 9.9 | 50 | 50 | 18 | 50 | 5.3 | 15 | 5 | 6.1 | 7.2 | 18 | 20 | 16 | 14 | 50 | 9.9 | 14 | 17 | 50 | 20 | 16 | 18 | 15 | 50 |
| Y | 50 | 8.7 | 18 | 50 | 19 | 4 | 20 | 8.7 | 5.4 | 6.4 | 2.8 | 50 | 50 | 20 | 50 | 3.1 | 14 | 0.2 | 1.4 | 0.6 | 20 | 3.6 | 11 | 50 | 50 | 50 | 9.6 | 50 | 50 | 20 | 8.9 | 15 | 9.8 | 50 |
| | S | L | P | S | G | W | T | Q | L | T | K | A | S | D | D | T | T | Y | Y | Y | N | K | T | T | D | V | V | T | N | T | R | P | T | D |

FIG.5.

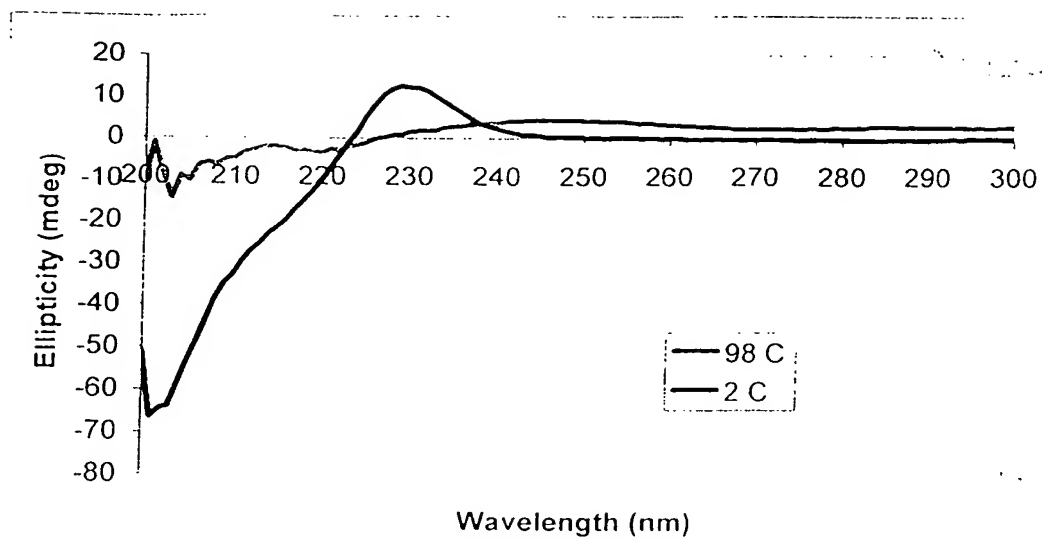


FIG. 6.

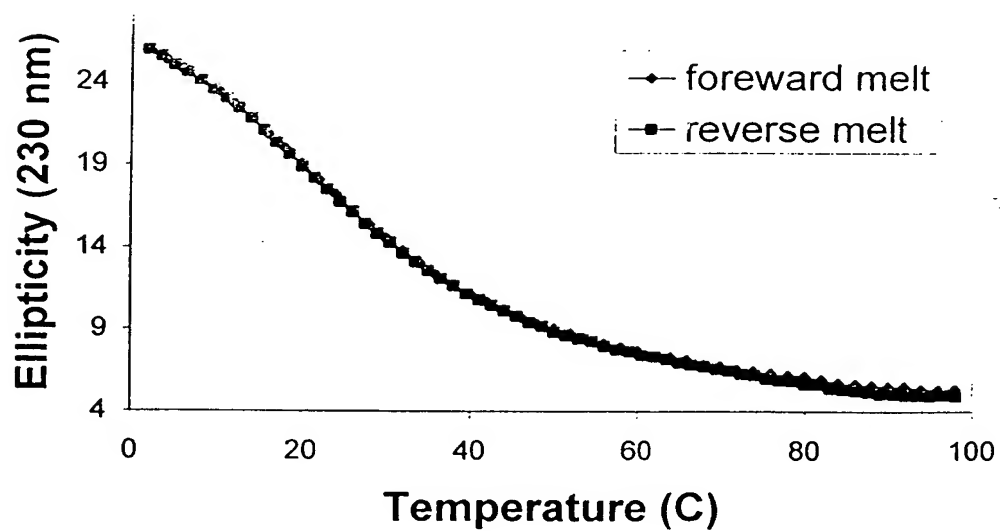


FIG. 7.

FIG. 8A.

library design using free energy limits

complexity $\sim 10^5$

```
SLPSGWTQLTKASDDTTYYYNKTTDVVTNTRPTD
N      K K SG N      Q SN K  N  N
D      P      E      Q
      V      S
      E
      R
```

FIG. 8B.

complexity $\sim 10^8$

```
SLPSGWTQLTKASDDTTYYYNKTTDVVTNTRPTD
N      KQK SGNNSV F  Q SNTKQD N  N
D      P      E      E  QT  Q
E      V      S
      E
      R
      N
```

FIG. 8C.

library design using probability limit

complexity $\sim 10^5$

```
SLPSGWTQLTKASDDTTYYYNKTTDVVTNTRPTD
N      K K SGNN V F  Q SN KQ  N  N
D
```

FIG. 8.

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